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07-17-00

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PTO/SB/05 (2/98)

UTILITY  
PATENT APPLICATION  
TRANSMITTAL

Attorney Docket No.

500188.02

First Inventor or Application Identifier

Jason B. Elledge

Title

APPARATUS FOR IN-SITU OPTICAL ENDPOINTING ON  
WEB-FORMAT PLANARIZING MACHINES IN  
MECHANICAL PLANARIZATION OF MICROELECTRONIC  
DEVICE SUBSTRATE ASSEMBLIES AND METHODS FOR  
MAKING AND USING SAME

(Only for nonprovisional applications under 37 CFR § 1.53(b))

Express Mail Label No.

EL476403717US

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 202311. ☒ General Authorization Form & Fee Transmittal  
(Submit an original and a duplicate for fee processing)2. ☒ Specification [Total Pages] **28**  
(preferred arrangement set forth below)

- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

3. ☒ Drawing(s) (35 USC 113) [Total Sheets] **9**4. Oath or Declaration [Total Pages] **1**

- a. ☐ Newly executed (original or copy)
- b. ☒ Copy from a prior application (37 CFR 1.63(d))  
(for continuation/divisional with Box 17 completed)
  - i. ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting  
inventor(s) named in the prior application,  
see 37 CFR 1.63(d)(2) and 1.33(b)

5. Incorporation By Reference (useable if box 4b is  
checked)☒ The entire disclosure of the prior application, from which  
a copy of the oath or declaration is supplied under Box  
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accompanying application and is hereby incorporated by  
reference therein.6. ☐ Microfiche Computer Program (Appendix)7. Nucleotide and Amino Acid Sequence Submission  
(if applicable, all necessary)

- a. ☐ Computer-Readable Copy
- b. ☐ Paper Copy (identical to computer copy)
- c. ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. ☐ Assignment Papers (cover sheet & document(s))9. ☒ 37 CFR 3 73(b) Statement ☒ Power of Attorney  
(when there is an assignee)10. ☐ English Translation Document (if applicable)11. ☐ Information Disclosure  
Statement (IDS)/PTO-1449 ☐ Copies of IDS  
Citations12. ☒ Preliminary Amendment13. ☒ Return Receipt Postcard14. ☐ Small Entity  
Statement(s) ☐ Statement filed in prior application,  
Status still proper and desired15. ☐ Certified Copy of Priority Document(s)  
(if foreign priority is claimed)16. ☒ Other: Certificate of Express Mail  
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17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information below and in a preliminary amendment

☐ Continuation ☒ Divisional ☐ Continuation-In-Part (CIP) of prior Application No.: 09/300,358Prior application information: Examiner Willie Berry, Jr.Group / Art Unit 3723

## CORRESPONDENCE ADDRESS

Mark W. Roberts, Esq.  
Dorsey & Whitney LLP  
1420 Fifth Avenue, Suite 3400  
Seattle, Washington 98101-4010  
(206) 903-8800 phone (206) 903-8820 fax

Respectfully submitted,

TYPED or PRINTED NAME Mark W. RobertsREGISTRATION NO. 46,160SIGNATURE Mark W. RobertsDate July 14, 2000

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**Present Application:**

Applicant : Jason B. Elledge  
Attorney Docket No.: 500188.02  
Filed : Concurrently herewith  
Title : APPARATUS FOR IN-SITU OPTICAL ENDPOINTING ON WEBFORMAT  
PLANARIZING MACHINES IN MECHANICAL PLANARIZATION OF  
MICROELECTRONIC-DEVICE SUBSTRATE ASSEMBLIES AND  
METHODS FOR MAKING AND USING SAME

**Prior Application:**

Examiner : Willie Berry, Jr.  
Art Unit : 3723  
Serial No. : 09/300,358

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**PRELIMINARY AMENDMENT**

Box Patent Application  
Assistant Commissioner of Patents  
Washington, D.C. 20231

Sir:

Please amend the above-identified application as follows:

**In the Specification:**

Amend the specification by inserting a new section before the "Technical Field" as follows:

-- CROSS-REFERENCE TO RELATED APPLICATION

This application is a divisional of pending United States Patent Application No. 09/300,358, filed April 26, 1999. --

In the Claims:

Please cancel claims 1-39.

Respectfully submitted,

DORSEY & WHITNEY LLP



Mark W. Roberts, Ph. D.  
Registration No. 46,160

MWR/srf

Enclosures:

Postcard

1420 Fifth Avenue, Suite 3400  
Seattle, WA 98101  
(206) 903-8800  
Fax 206) 903-8820

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APPARATUS FOR IN-SITU OPTICAL ENDPOINTING ON WEB-FORMAT  
PLANARIZING MACHINES IN MECHANICAL OR CHEMICAL-  
MECHANICAL PLANARIZATION OF MICROELECTRONIC-DEVICE  
SUBSTRATE ASSEMBLIES AND METHODS FOR MAKING AND USING  
SAME

5

TECHNICAL FIELD

The present invention relates to devices for endpointing mechanical and/or chemical-mechanical planarizing processes of microelectronic-device substrate assemblies and, more particularly, to web-format polishing pads and planarizing machines for in-situ optical endpointing.

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BACKGROUND OF THE INVENTION

Mechanical and chemical-mechanical planarizing processes (collectively "CMP") are used in the manufacturing of electronic devices for forming a flat surface on semiconductor wafers, field emission displays and many other microelectronic-device substrate assemblies. CMP processes generally remove material from a substrate assembly to create a highly planar surface at a precise elevation in the layers of material on the substrate assembly.

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Figure 1 is a schematic isometric view of a web-format planarizing machine 10 that has a table 11 with a support surface 13. The support surface 13 is generally a rigid panel or plate attached to the table 11 to provide a flat, solid workstation for supporting a portion of a web-format planarizing pad 40 in a planarizing zone "A" during planarization. The planarizing machine 10 also has a pad advancing mechanism including a plurality of rollers to guide, position, and hold the web-format pad 40 over the support surface 13. The pad advancing mechanism generally includes a supply roller 20, first and second idler rollers 21a and 21b, first and second guide rollers 22a and 22b, and a take-up roller 23. As explained below, a motor (not shown) drives the take-up roller 23 to advance the pad 40 across the support surface 13 along a travel axis T-T. The motor can

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also drive the supply roller 20. The first idler roller 21a and the first guide roller 22a press an operative portion of the pad against the support surface 13 to hold the pad 40 stationary during operation.

The planarizing machine 10 also has a carrier assembly 30 to  
 5 translate a substrate assembly 12 across the pad 40. In one embodiment, the carrier assembly 30 has a head 32 to pick up, hold and release the substrate assembly 12 at appropriate stages of the planarizing process. The carrier assembly 30 also has a support gantry 34 and a drive assembly 35 that can move along the gantry 34. The drive assembly 35 has an actuator 36, a drive shaft 37  
 10 coupled to the actuator 36, and an arm 38 projecting from the drive shaft 37. The arm 38 carries the head 32 via another shaft 39. The actuator 36 orbits the head 32 about an axis B-B to move the substrate assembly 12 across the pad 40.

The polishing pad 40 may be a non-abrasive polymeric web (*e.g.*, a polyurethane sheet), or it may be a fixed abrasive polishing pad having abrasive  
 15 particles fixedly dispersed in a resin or some other type of suspension medium. During planarization of the substrate assembly 12, a planarizing fluid 44 flows from a plurality of nozzles 45. The planarizing fluid 44 may be a conventional CMP slurry with abrasive particles and chemicals that etch and/or oxidize the substrate assembly 12, or the planarizing fluid 44 may be a "clean" non-abrasive  
 20 planarizing solution without abrasive particles. In most CMP applications, abrasive slurries are used on non-abrasive polishing pads, and clean solutions are used on fixed abrasive polishing pads.

In the operation of the planarizing machine 10, the pad 40 moves across the support surface 13 along the pad travel path T-T either during or  
 25 between planarizing cycles to change the particular portion of the polishing pad 40 in the planarizing zone A. For example, the supply and take-up rollers 20 and 23 can drive the polishing pad 40 between planarizing cycles such that a point P moves incrementally across the support surface 13 to a number of intermediate locations  $I_1$ ,  $I_2$ , etc. Alternatively, the rollers 20 and 23 may drive the polishing  
 30 pad 40 between planarizing cycles such that the point P moves all the way across

the support surface 13 to completely remove a used portion of the pad 40 from the planarizing zone A. The rollers may also continuously drive the polishing pad 40 at a slow rate during a planarizing cycle such that the point P moves continuously across the support surface 13. Thus, the polishing pad 40 should be  
 5 free to move axially over the length of the support surface 13 along the pad travel path T-T.

CMP processes should consistently and accurately produce a uniform, planar surface on substrate assemblies to enable circuit and device patterns to be formed with photolithography techniques. As the density of  
 10 integrated circuits increases, it is often necessary to accurately focus the critical dimensions of the photo-patterns to within a tolerance of approximately  $0.1\text{ }\mu\text{m}$ . Focusing photo-patterns to such small tolerances, however, is difficult when the planarized surfaces of substrate assemblies are not uniformly planar. Thus, to be effective, CMP processes should create highly uniform, planar surfaces on  
 15 substrate assemblies.

In the highly competitive semiconductor industry, it is also desirable to maximize the throughput of CMP processing by producing a planar surface on a substrate assembly as quickly as possible. The throughput of CMP processing is a function of several factors, one of which is the ability to  
 20 accurately stop CMP processing at a desired endpoint. In a typical CMP process, the desired endpoint is reached when the surface of the substrate assembly is planar and/or when enough material has been removed from the substrate assembly to form discrete components on the substrate assembly (e.g., shallow trench isolation areas, contacts, damascene lines, etc.). Accurately stopping  
 25 CMP processing at a desired endpoint is important for maintaining a high throughput because the substrate assembly may need to be re-polished if it is "under-planarized." Accurately stopping CMP processing at the desired endpoint is also important because too much material can be removed from the substrate assembly, and thus it may be "over-polished." For example, over-  
 30 polishing can cause "dishing" in shallow-trench isolation structures or

completely destroy a section of the substrate assembly. Thus, it is highly desirable to stop CMP processing at the desired endpoint.

In one conventional method for determining the endpoint of CMP processing, the planarizing period of a particular substrate assembly is estimated using an estimated polishing rate based upon the polishing rate of identical substrate assemblies that were planarized under the same conditions. The estimated planarizing period for a particular substrate assembly, however, may not be accurate because the polishing rate may change from one substrate assembly to another. Thus, this method may not produce accurate results.

In another method for determining the endpoint of CMP processing, the substrate assembly is removed from the pad and then a measuring device measures a change in thickness of the substrate assembly. Removing the substrate assembly from the pad, however, interrupts the planarizing process and may damage the substrate assembly. Thus, this method generally reduces the throughput of CMP processing.

U.S. Patent No. 5,433,651 issued to Lustig et al. ("Lustig") discloses an in-situ chemical-mechanical polishing machine for monitoring the polishing process during a planarizing cycle. The polishing machine has a rotatable polishing table including a window embedded in the table. A polishing pad is attached to the table, and the pad has an aperture aligned with the window embedded in the table. The window is positioned at a location over which the workpiece can pass for in-situ viewing of a polishing surface of the workpiece from beneath the polishing table. The planarizing machine also includes a reflectance measurement means coupled to the window on the underside of the rotatable polishing table for providing a reflectance signal representative of an in-situ reflectance of the polishing surface of the workpiece.

Although the apparatus disclosed in Lustig is an improvement over other CMP endpointing techniques, it cannot work in web-format planarizing applications because web-format planarizing machines have stationary support tables over which web-format polishing pads move either during or between

planarizing cycles. For example, if the polishing pad in Lustig was used on a web-format machine that advances the pad over a stationary table, the single circular aperture in Lustig's polishing pad would become misaligned with a window in the stationary table. The polishing pad disclosed in Lustig would then  
 5 block a light beam from a reflectance or interferometric endpointing device under the stationary table. As such, the in-situ endpointing apparatus disclosed in Lustig would not work with web-format planarizing machines.

#### SUMMARY OF THE INVENTION

The present invention is directed toward polishing pads,  
 10 planarizing machines and methods for mechanical and/or chemical-mechanical planarization of microelectronic-device substrate assemblies. The polishing pads and the planarizing machines, for example, can be web-format type devices. In a typical application, the web-format machines have a pad advancing mechanism and stationary table with a first dimension extending along a pad travel path, a  
 15 second dimension transverse to the first dimension, and an illumination site from which a laser beam can emanate from the table. The pad advancing mechanism moves the pad along the pad travel path to replace a worn portion of the pad with a fresh portion. In one embodiment of the invention, a web-format polishing pad includes a planarizing medium and an optical pass-through system having a  
 20 plurality of view sites through which a light beam can pass through the pad. The planarizing medium can have a planarizing surface configured to engage the substrate assembly and a backside to face towards the table. The view sites of the optical pass-through system extend along the pad in a direction generally parallel to the pad travel path so that a view site can be aligned with the  
 25 illumination site on the table as the pad moves across the table.

In one particular embodiment of the invention, the polishing pad further includes an optically transmissive backing sheet under the planarizing medium and a backing pad under the backing sheet. For example, the planarizing medium can be disposed on a top surface of the backing sheet and the



backing pad can be attached to an under surface of the backing sheet. The optical pass-through system can include an elongated slot or a plurality of discrete openings through both the planarizing medium and the backing pad that extend in a line along the length of the pad in the direction generally parallel to the pad travel path. The view sites are accordingly locations along the elongated slots or the discrete openings through which a laser can pass to detect the end point of a substrate assembly in-situ and during the planarizing cycle.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view of a web-format planarizing machine in accordance with the prior art.

Figure 2 is an isometric view with a cut-away portion of a web-format planarizing machine and a web-format polishing pad in accordance with one embodiment of the invention.

Figure 3 is a cross-sectional view of the polishing pad of Figure 2 taken along line 3-3.

Figure 4 is a cross-sectional view of a web-format polishing pad in accordance with another embodiment of the invention.

Figure 5 is a cross-sectional view of a web-format polishing pad in accordance with yet another embodiment of the invention.

Figure 6 is a cross-sectional view of a web-format polishing pad in accordance with still another embodiment of the invention.

Figure 7 is a cross-sectional view of a web-format polishing pad in accordance with an additional embodiment of the invention.

Figure 8 is an isometric view of a web-format planarizing machine and a web-format polishing pad in accordance with another embodiment of the invention.

Figure 9 is a cross-sectional view partially illustrating the planarizing machine and the polishing pad of Figure 8 taken along line 9-9.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed toward polishing pads, planarizing machines, and methods for endpointing mechanical and/or chemical-mechanical planarizing processes of microelectronic-device substrate assemblies.

5 Many specific details of the invention are described below with reference to web-format planarizing applications to provide a thorough understanding of such embodiments. The present invention, however, may be practiced in other applications, such as using individual polishing pads that are approximately the same size as a platen or table. Thus, one skilled in the art will understand that  
10 the present invention may have additional embodiments, or that the invention may be practiced without several of the details described in the following description.

Figure 2 is an isometric view of a web-format planarizing machine 100 with a polishing pad 150 in accordance with an embodiment of the  
15 invention. The planarizing machine 100 has a table 102 including a stationary support surface 104, an opening 105 at an illumination site in the support surface 104, and a shelf 106 under the support surface 104. The planarizing machine 100 also includes an optical endpoint sensor 108 mounted to the shelf 106 at the illumination site. The optical endpoint sensor 108 projects a light beam 109  
20 through the hole 105 and the support surface 104. The optical endpoint sensor 108 can be a reflectance device or an interferometer that emits the light beam 109 and senses a return beam (not shown) to determine the surface condition of a substrate assembly 12 in-situ and in real time. Reflectance and interferometer endpoint sensors that may be suitable for the optical sensor 108 are disclosed in  
25 U.S. Patent Nos. 5,648,847; 5,337,144; 5,777,739; 5,663,797; 5,465,154; 5,461,007; 5,433,651; 5,413,941; 5,369,488; 5,324,381; 5,220,405; 4,717,255; 4,660,980; 4,640,002; 4,422,764; 4,377,028; 5,081,796; 4,367,044; 4,358,338; 4,203,799; 4,200,395; and U.S. Application No. 09/066,044, all of which are herein incorporated by reference. Another suitable optical endpoint sensor is

used in the Mirra® CMP system manufactured by Applied Materials of California.

The planarizing machine 100 can further include a pad advancing mechanism having a plurality of rollers 120, 121a, 121b, 122a, 122b and 123 that  
 5 are substantially the same as the roller system described above with reference to the planarizing machine 10 in Figure 1. Additionally, the planarizing machine 100 can include a carrier assembly 130 that is substantially the same as the carrier assembly 30 described above with reference to Figure 1.

Figure 3 is a cross-sectional view partially illustrating the polishing  
 10 pad 150, the support surface 104, and the optical endpoint sensor 108. Referring to Figures 2 and 3 together, the polishing pad 150 has a planarizing medium 151 with a first section 152a, a second section 152b, and a planarizing surface 154 defined by the upper surfaces of the first and second sections 152a and 152b. The planarizing medium 151 can be an abrasive or a non-abrasive material. For  
 15 example, an abrasive planarizing medium 151 can have a resin binder and abrasive particles distributed in the resin binder. Suitable abrasive planarizing mediums 151 are disclosed in U.S. Patent Nos. 5,645,471; 5,879,222; 5,624,303; and U.S. Patent Application Nos. 09/164,916 and 09/001,333, all of which are herein incorporated by reference. In this embodiment, the polishing pad 150 also  
 20 includes an optically transmissive backing sheet 160 under the planarizing medium 151 and a resilient backing pad 170 under the backing sheet 160. The planarizing medium 151 can be disposed on a top surface 162 of the backing sheet 160, and the backing pad 170 can be attached to an under surface 164 of the backing sheet 160. The backing sheet 160, for example, can be a continuous  
 25 sheet of polyester (*e.g.*, Mylar®) or polycarbonate (*e.g.*, Lexan®). The backing pad 170 can be a polyurethane or other type of compressible material. In one particular embodiment, the planarizing medium 151 is an abrasive material having abrasive particles, the backing sheet 160 is a long continuous sheet of Mylar, and the backing pad 170 is a compressible polyurethane foam.

The polishing pad 150 also has an optical pass-through system to allow the light beam 109 to pass through the pad 150 and illuminate an area on the bottom face of the substrate assembly 12 irrespective of whether a point P on the pad 150 is at intermediate position  $I_1$ ,  $I_2$ ... or  $I_n$  (Figure 2). In this embodiment, the optical pass-through system includes a first view port defined by a first elongated slot 180 through the planarizing medium 151 and a second view port defined by a second elongated slot 182 (Figure 3 only) through the backing pad 170. The first and second elongated slots 180 and 182 can extend along the length of the polishing pad 150 in a direction generally parallel to a pad travel path T-T. The first and second slots 180 and 182 are also aligned with the hole 105 in the support surface 104 so that the light beam 109 can pass through any view site along the first and second slots 180 and 182. For the purposes of this embodiment, a view site of the optical pass-through system is any location along the first and second elongated slots 180 and 182 positioned over the hole 105. For example, when the point P is at intermediate location  $I_1$ , a view site 184 along the first and second elongated slots 180 and 182 is aligned with the hole 105. After the polishing pad 150 has moved along the pad travel path T-T so that the point P is at intermediate position  $I_2$ , another view site 185 along the first and second elongated slots 180 and 182 is aligned with the hole 105.

The embodiment of the polishing pad 150 shown in Figures 2 and 3 allows the optical endpointing sensor 108 to detect the surface condition of the substrate assembly 12 in-situ and in real time during a planarizing cycle on the web-format planarizing machine 100. In operation, the carrier assembly 130 moves the polishing pad 12 across the planarizing surface 154 as a planarizing solution 144 flows on to the polishing pad 150. The planarizing solution 144 is generally a clear, non-abrasive solution that does not block the light beam 109 from passing through the first elongated slot 180. As the carrier assembly 130 moves the substrate assembly 12, the light beam 109 passes through the optically transmissive backing sheet 160 and the clean planarizing solution in the first elongated slot 180 to illuminate the face of the substrate assembly 12 (Figure 3).

The optical endpoint sensor 108 thus periodically detects the surface condition of the substrate assembly 12 throughout the planarizing cycle. The optical endpoint sensor 108 can also indicate when the surface condition corresponds to the desired endpoint of the planarizing process. The substrate assembly 12 is then removed from the polishing pad 150 and another substrate assembly is loaded into the head 132 for planarization. The rollers 120 and 123 also incrementally advance the polishing pad 150 along the pad travel path T-T to move the point P from one intermediate position to another. The view site along the first and second elongated slots 180 and 182 accordingly changes to allow the light beam 109 to pass through another portion of the optical pass-through system of the polishing pad 150. The carrier assembly 130 then moves the second substrate assembly over the planarizing surface 154 and the illumination site to planarize the second substrate assembly. The polishing pad 150 accordingly allows the light beam 109 to pass through any portion of the polishing pad 150 positioned over the illumination site as the polishing pad 150 moves with respect to the table 102.

Figure 4 is a cross-sectional view of a polishing pad 250 in accordance with another embodiment of the invention. The polishing pad 250 has the planarizing medium 151 disposed on the top surface 162 of the optically transmissive backing sheet 160, but the polishing pad 250 does not have a backing pad 170 attached to the backing sheet 160. The optical pass-through system of this embodiment includes the optically transmissive backing sheet 160 and the first elongated slot 180.

Figure 5 is a cross-sectional view of a polishing pad 350 in accordance with still another embodiment of the invention. The polishing pad 350 has the planarizing medium 151 disposed on a top surface 362 of a backing sheet 360. The polishing pad 350 differs from the polishing pad 250 shown in Figure 4 in that the backing sheet 360 of the polishing pad 350 also includes a flat-topped ridge 365 projecting upwardly into the elongated slot 180 between the first and second sections 152a and 152b of the planarizing medium 151. The

polishing pad 250 illustrated in Figure 4 is expected to be particularly effective for use with clean planarizing solutions because these solutions do not block the light beam 109 from passing through the elongated slot 180 during planarization. The polishing pad 350 shown in Figure 5 is expected to be particularly effective  
 5 for use with abrasive or otherwise opaque planarizing solutions because the ridge 365 on the optically transmissive backing sheet 360 maintains an optically transmissive path from the face of the substrate 12 to the optical endpoint sensor 108.

Figure 6 is a cross-sectional view illustrating another polishing pad  
 10 450 in accordance with yet another embodiment of the invention. The polishing pad 450 includes the planarizing medium 151 and the compressible backing pad 170, but it does not include an optically transmissive backing sheet 160. In this embodiment, the first and second sections 152a and 152b of the planarizing medium are disposed on a first surface 172 of the backing pad 170. The optical  
 15 pass-through system of this embodiment, therefore, includes the first elongated slot 180 through the polishing medium 151 and the second elongated slot 182 through the backing pad 170. In this particular embodiment, the backing pad 170 may also include an optically transmissive insert 178 in the second elongated slot 182 to prevent the planarizing solution 144 (Figure 2) from dripping onto the  
 20 optical endpoint sensor 108.

Figure 7 is a cross-sectional view of a polishing pad 550 in accordance with still another embodiment of the invention. The polishing pad 550 is an optically transmissive pad having a planarizing medium 551 and a flat surface 581. The pad 550, for example, can be a hard polyester (*e.g.*, Mylar) or a  
 25 hard polycarbonate (*e.g.*, Lexan), and the planarizing medium 551 can be a roughened surface on the polyester or polycarbonate. The optical pass-through system is defined by the flat surface 581 and the portion of the pad 550 under the flat surface 581. In one particular embodiment, the flat surface 581 is an elongated surface extending generally parallel to the pad travel path T-T (Figure  
 30 2) along the length of the pad.

Figure 8 is an isometric view of the planarizing machine 100 with a polishing pad 650 in accordance with another embodiment of the invention, and Figure 9 is a cross-sectional view partially illustrating the polishing pad 650 along line 9-9. Referring to Figure 9, the polishing pad 650 has a planarizing medium 651 with a planarizing surface 654, an optically transmissive backing sheet 660 under the planarizing medium 651, and a compressible backing pad 670 under the optically transmissive backing sheet 660. The polishing pad 650 also has an optical pass-through system including at least one view port 680 in the planarizing medium 651 and at least one view port 682 in the backing pad 670. The optical pass-through system, for example, can include a first plurality of holes 680 through the planarizing medium 651 and a second plurality of orifices 682 through the backing pad 670. The holes 680 and the orifices 682 are arranged in a line extending generally parallel to the pad travel path T-T (Figure 8). For example, as best shown by Figure 9, the optical pass-through system of this embodiment includes discrete holes 680a-680c in the planarizing medium 651 and corresponding discrete orifices 682a-682c in the backing pad 670. Each orifice 682 in the backing pad 670 is aligned with a corresponding hole 680 in the planarizing medium 651, and each pair of aligned holes 680 and 682 defines a view site of the optical pass-through system for the polishing pad 650. As a result, the light beam 109 can pass through the polishing pad 650 when a view site having a pair of holes 680 and 682 is aligned with the illumination site.

From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. For example, several embodiments of the invention may also include polishing pads with a circular shape or other shapes for use on rotary polishing machines. Accordingly, the invention is not limited except as by the appended claims.

## CLAIMS

1. A polishing pad for mechanical or chemical-mechanical planarization of microelectronic-device substrate assemblies on a stationary table having a first dimension extending along a pad travel path and an illumination site from which a light beam can emanate from the table, the pad comprising:

a planarizing medium having a planarizing surface configured to engage a substrate assembly and a backside to face towards the table, the planarizing medium being moveable over the table along the pad travel path to place a fresh portion of the planarizing surface at one side of a planarizing zone on the table and to remove a worn portion of the planarizing surface from an opposite side of the planarizing zone; and

an optical pass-through system in the planarizing medium, the optical pass-through system having a plurality of view sites extending along a length of the planarizing medium in a direction generally parallel to the pad travel path, each view site providing an optically transmissive path through the pad.

2. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface and a under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises at least one opening in the planarizing medium alignable with the illumination site on the table and at least one orifice in the backing pad at least partially aligned with the opening in the planarizing medium.

3. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and



wherein the optical pass-through system comprises an elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a plurality of openings through the backing pad and arranged in a line aligned with the elongated slot through the planarizing medium.

4. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

5. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface, an under surface, and a flat-topped ridge extending in the direction generally parallel to the pad travel path and alignable with the illumination site;

a backing pad attached to the under surface of the backing sheet;

wherein the planarizing medium comprises a first section of abrasive material disposed on the top surface of the backing sheet on one side of the ridge and a second section of abrasive material disposed on the top surface of the backing sheet on the other side of the ridge; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium between the first and second sections of abrasive material, the ridge being positioned in the elongated slot, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

6. The polishing pad of claim 1 wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

7. The polishing pad of claim 1 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being separately alignable with the illumination site according to the portion of the pad over the illumination site.

8. The polishing pad of claim 1, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

9. The polishing pad of claim 1, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the optical pass-through system comprises a plurality of holes through the planarizing

medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole defining a separate view site.

10. The polishing pad of claim 1, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a second elongated slot through the backing pad aligned with the first slot through the planarizing medium.

11. The polishing pad of claim 1, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, and the optical pass-through system further comprises a second plurality of holes in which each hole of the second plurality of holes is aligned with a corresponding hole of the first plurality of holes.

12. The polishing pad of claim 1, further comprising an optically transmissive backing sheet having a top surface and an under surface, and wherein the planarizing medium is an abrasive layer having a resin and abrasive particles distributed in the resin, the planarizing medium being disposed on the top surface of the backing sheet.

13. The polishing pad of claim 12 wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along

the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section.

14. The polishing pad of claim 12 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being alignable with the illumination site as the pad incrementally moves over the table.

15. A polishing pad for chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

an optically transmissive backing sheet having a top surface and an under surface;

a backing pad attached to the under surface of the backing sheet, the backing pad having at least one viewing port; and

a planarizing medium disposed on the top surface of the backing sheet, the planarizing medium having at least one viewing port at least partially aligned with the viewing port in the backing pad.

16. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises a first elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the first slot dividing the planarizing medium into a first section and a second section; and

the at least one viewing port in the backing pad comprises a second elongated slot through the backing pad that extends in the direction generally parallel to the pad travel path in alignment with the first slot.

17. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises an elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the slot dividing the planarizing medium into a first section and a second section; and

the at least one viewing port in the backing pad comprises a plurality of orifices in alignment with the slot.

18. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises a plurality of holes through the planarizing medium, the holes being arranged in a line that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium; and

the at least one viewing port in the backing pad comprises a slot through the backing pad that extends in the direction generally parallel to the pad travel path in alignment with the plurality of holes.

19. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises a plurality of holes through the planarizing medium, the holes being arranged in a line that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium; and

the at least one viewing port in the backing pad comprises a plurality of orifices through the backing pad, each orifice in the backing pad being aligned with a corresponding hole through the planarizing medium.

20. A polishing pad for chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

an optically transmissive backing sheet having a top surface and an under surface; and

a planarizing medium disposed on the top surface of the backing sheet, the planarizing medium having at least one viewing port configured to be aligned with the illumination site in the table.

21. The polishing pad of claim 20 wherein the viewing port in the planarizing medium comprises an elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the slot dividing the planarizing medium into a first section and a second section.

22. The polishing pad of claim 20 wherein:

the viewing port in the planarizing medium comprises an elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the slot dividing the planarizing medium into a first section and a second section; and

the backing sheet includes a flat-top ridge projecting from the top surface and positioned in the slot.

23. The polishing pad of claim 20 wherein the viewing port in the planarizing medium comprises a plurality of holes through the planarizing medium, the holes being arranged in a line that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium.

24. The polishing pad of claim 20, further comprising:

a backing pad attached to the under surface of the backing sheet, the backing pad having a slot through the backing pad that extends in the direction generally parallel to the pad travel path in alignment with the viewing port in the planarizing medium.

25. A planarizing machine for mechanical or chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

a table including a support surface having a first dimension extending along a pad travel path, a second dimension transverse to the first dimension and a planarizing at zone at least within the first and second dimensions;

a light source under to the table at an illumination site from which a light beam can emanate from the support surface of the table;

a polishing pad moveably coupled to the support surface of the table, the pad including a planarizing medium and an optical pass-through system, wherein the planarizing medium includes a planarizing surface configured to engage a substrate assembly and a backside to face towards the table, and wherein the optical pass-through system includes a plurality of view sites along a length of the pad in a direction generally parallel to the pad travel path, each view site providing an optically transmissive path through the pad;

a pad advancing mechanism engaged with the pad, the advancing mechanism being configured to move the pad over the table along the pad travel path to place a fresh portion of the planarizing surface at one side of a planarizing zone on the table and to remove a worn portion of the planarizing surface from an opposite side of the planarizing zone; and

a carrier assembly having a head for holding a substrate assembly and a drive assembly connected to the head to move the substrate assembly with respect to the polishing pad.

26. The polishing pad of claim 25, further comprising:

an optically transmissive backing sheet having a top surface and a under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises at least one opening in the planarizing medium alignable with the illumination site on the table and at least

one orifice in the backing pad at least partially aligned with the opening in the planarizing medium.

27. The polishing pad of claim 25, further comprising:  
an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;  
a backing pad attached to the under surface of the backing sheet; and  
wherein the optical pass-through system comprises an elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a plurality of openings through the backing pad and arranged in a line aligned with the elongated slot through the planarizing medium.

28. The polishing pad of claim 25, further comprising:  
an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;  
a backing pad attached to the under surface of the backing sheet; and  
wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.



29. The polishing pad of claim 25, further comprising:

an optically transmissive backing sheet having a top surface, an under surface, and a flat-topped ridge extending in the direction generally parallel to the pad travel path and alignable with the illumination site;

a backing pad attached to the under surface of the backing sheet;

wherein the planarizing medium comprises a first section of abrasive material disposed on the top surface of the backing sheet on one side of the ridge and a second section of abrasive material disposed on the top surface of the backing sheet on the other side of the ridge; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium between the first and second sections of abrasive material, the ridge being positioned in the elongated slot, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

30. The polishing pad of claim 25 wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

31. The polishing pad of claim 25 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being separately alignable with the illumination site according to the portion of the pad over the illumination site.

32. The polishing pad of claim 25, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the

optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

33. The polishing pad of claim 25, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole defining a separate view site.

34. The polishing pad of claim 25, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section, and the pass-through system further comprises a second elongated slot through the backing pad aligned with the first slot through the planarizing medium.

35. The polishing pad of claim 17, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, and the optical pass-through system further comprises a second plurality of holes in which each hole of the second plurality of holes is aligned with a corresponding hole of the first plurality of holes.

36. The polishing pad of claim 25, further comprising an optically transmissive backing sheet having a top surface and an under surface, and wherein the planarizing medium is an abrasive layer having a resin and abrasive particles distributed in the resin, the planarizing medium being disposed on the top surface of the backing sheet.

37. The polishing pad of claim 36 wherein the optical pass-through system comprises an elongated slot through the planarizing medium and extending along the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section.

38. The polishing pad of claim 36 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being alignable with the illumination site as the pad incrementally moves over the table.

39. A planarizing machine for mechanical or chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

a table including a support surface having a first dimension extending along a pad travel path, a second dimension transverse to the first dimension and a planarizing zone at least within the first and second dimensions;

a light source attached to the table at an illumination site from which a light beam can emanate from the support surface of the table;

a polishing pad moveably coupled to the support surface of the table, the pad including an optically transmissive backing sheet having an under surface facing the table and a top surface, the pad also including a planarizing medium disposed on the top surface of the backing sheet, and the planarizing medium having at least one opening configured to be aligned with the illumination site in the table;

a pad advancing mechanism engaged with the pad, the advancing mechanism configured to move the pad over the table along the pad travel path to place a fresh portion of the planarizing surface at one end of a planarizing zone on the table and to remove a worn portion of the planarizing surface from an opposite end of the planarizing zone; and

a carrier assembly having a head for holding a substrate assembly and a drive assembly connected to the head to move the substrate assembly with respect to the polishing pad.

40. A method of endpointing mechanical or chemical-mechanical planarization processing of microelectronic-device substrate assemblies, comprising:

initially passing a light beam from an illumination site in a table through a first optically transmissive view site in a polishing pad to at least periodically impinge a first substrate assembly with the light beam and optically sense a surface condition of the first substrate assembly;

advancing the polishing pad relative to the table and the illumination site after planarizing the first substrate assembly; and

subsequently passing a light beam from the illumination site in the table through a second optically transmissive view site in the polishing pad to at least periodically impinge a second substrate assembly with the light beam and optically sense a surface condition of the second substrate assembly.

41. The method of claim 40 wherein:

the polishing pad comprises a planarizing medium having an elongated slot that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first area of the elongated slot; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second area of the elongated slot spaced apart from the first area.

42. The method of claim 40 wherein:

the polishing pad comprises a planarizing medium having a plurality of openings arranged in a line that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first discrete opening in the planarizing medium; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second discrete opening in the planarizing medium spaced apart from the first opening.

43. A method for planarizing microelectronic-device substrate assemblies, comprising:

removing material from a first substrate assembly by pressing the first substrate assembly against a planarizing surface of a polishing pad and moving the first substrate assembly with respect to the polishing pad;

initially passing a light beam from an illumination site in the table through an optically transmissive view site in the polishing pad to at least periodically impinge the first substrate assembly with the light beam and optically sense a surface condition of the first substrate assembly until the sensed surface condition indicates that the first substrate assembly has reached a desired endpoint;

advancing the polishing pad relative to the table and the illumination site after planarizing the first substrate assembly;

removing material from a second substrate assembly by pressing the second substrate assembly against the planarizing surface of the polishing pad and moving the second substrate assembly with respect to the polishing pad; and

subsequently passing a light beam from the illumination site in the table through another optically transmissive view site in the polishing pad to at least periodically impinge the second substrate assembly with the light beam and optically

sense a surface condition of the second substrate assembly until the sensed surface condition indicates that the second substrate assembly has reached a desired endpoint.

44. The method of claim 43 wherein:

the polishing pad comprises a planarizing medium having an elongated slot that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first area of the elongated slot; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second area of the elongated slot spaced apart from the first area.

45. The method of claim 43 wherein:

the polishing pad comprises a planarizing medium having a plurality of openings arranged in a line that extends in a direction generally parallel to the pad travel path;

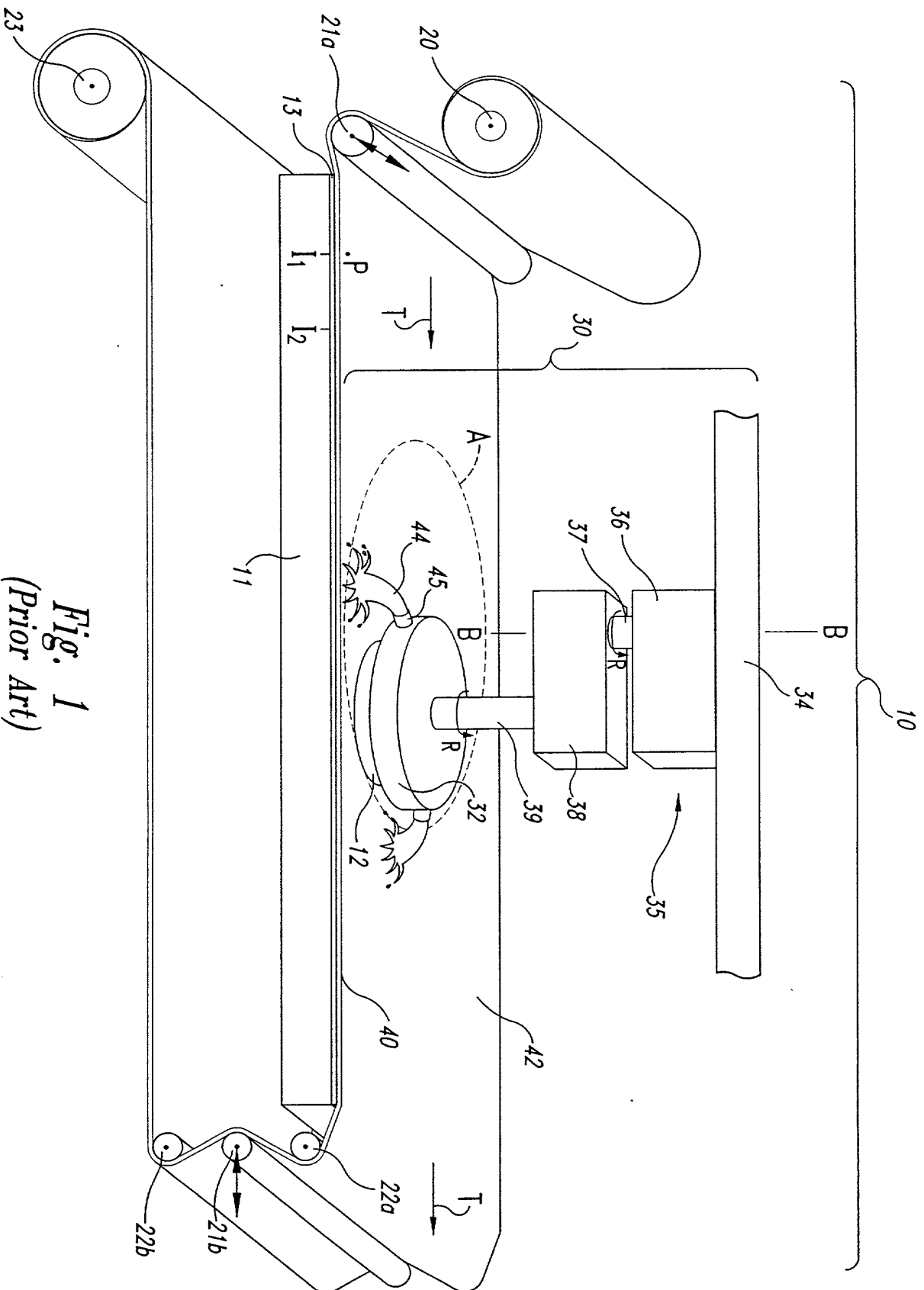
initially passing the light beam through the first view site comprises passing the light beam through a first discrete opening in the planarizing medium; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second discrete opening in the planarizing medium spaced apart from the first opening.

APPARATUS FOR IN-SITU OPTICAL ENDPOINTING ON WEB-FORMAT  
PLANARIZING MACHINES IN MECHANICAL OR CHEMICAL-MECHANICAL  
PLANARIZATION OF MICROELECTRONIC-DEVICE SUBSTRATE  
ASSEMBLIES AND METHODS FOR MAKING AND USING SAME

ABSTRACT OF THE DISCLOSURE

Polishing pads, planarizing machines and methods for mechanical and/or chemical-mechanical planarization of microelectronic-device substrate assemblies. The polishing pads, for example, can be web-format pads, and the planarizing machines can be web-format machines. In a typical application, the web-format machines have a pad advancing mechanism and stationary table with a first dimension extending along a pad travel path, a second dimension transverse to the first dimension, and an illumination site from which a laser beam can emanate from the table. The pad advancing mechanism moves the pad along the pad travel path to replace worn portions of the pad with fresh portions. In one embodiment of the invention, a web-format polishing pad includes a planarizing medium and an optical pass-through system having a plurality of view sites through which a light beam can pass through the pad. The planarizing medium can have a planarizing surface configured to engage the substrate assembly and a backside to face towards the table. The view sites of the optical pass-through system extend along the pad in a direction generally parallel to the pad travel path so that a view site is aligned with the illumination site on the table as the pad moves across the table.



*Fig. 1*  
*(Prior Art)*



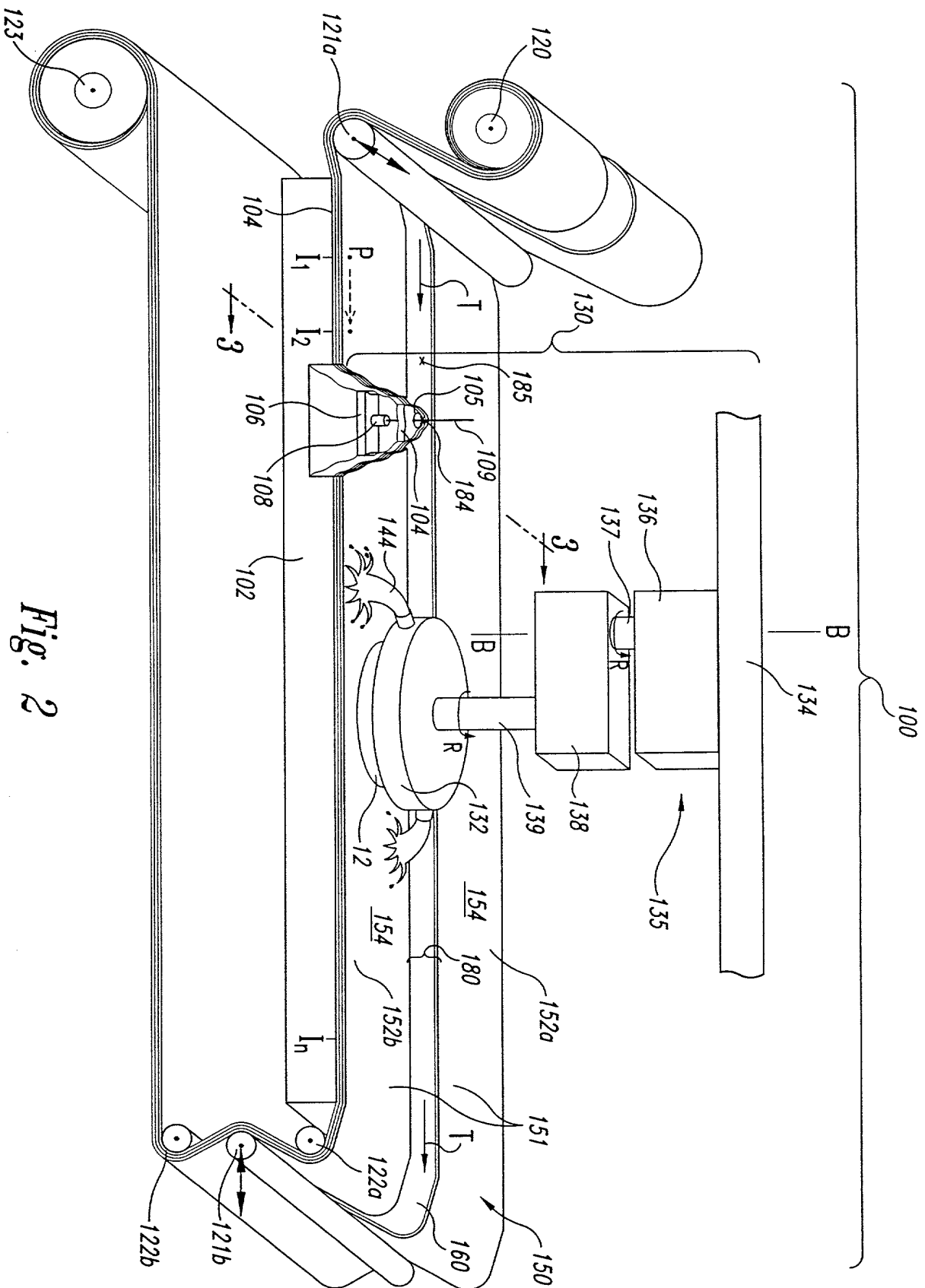


Fig. 2

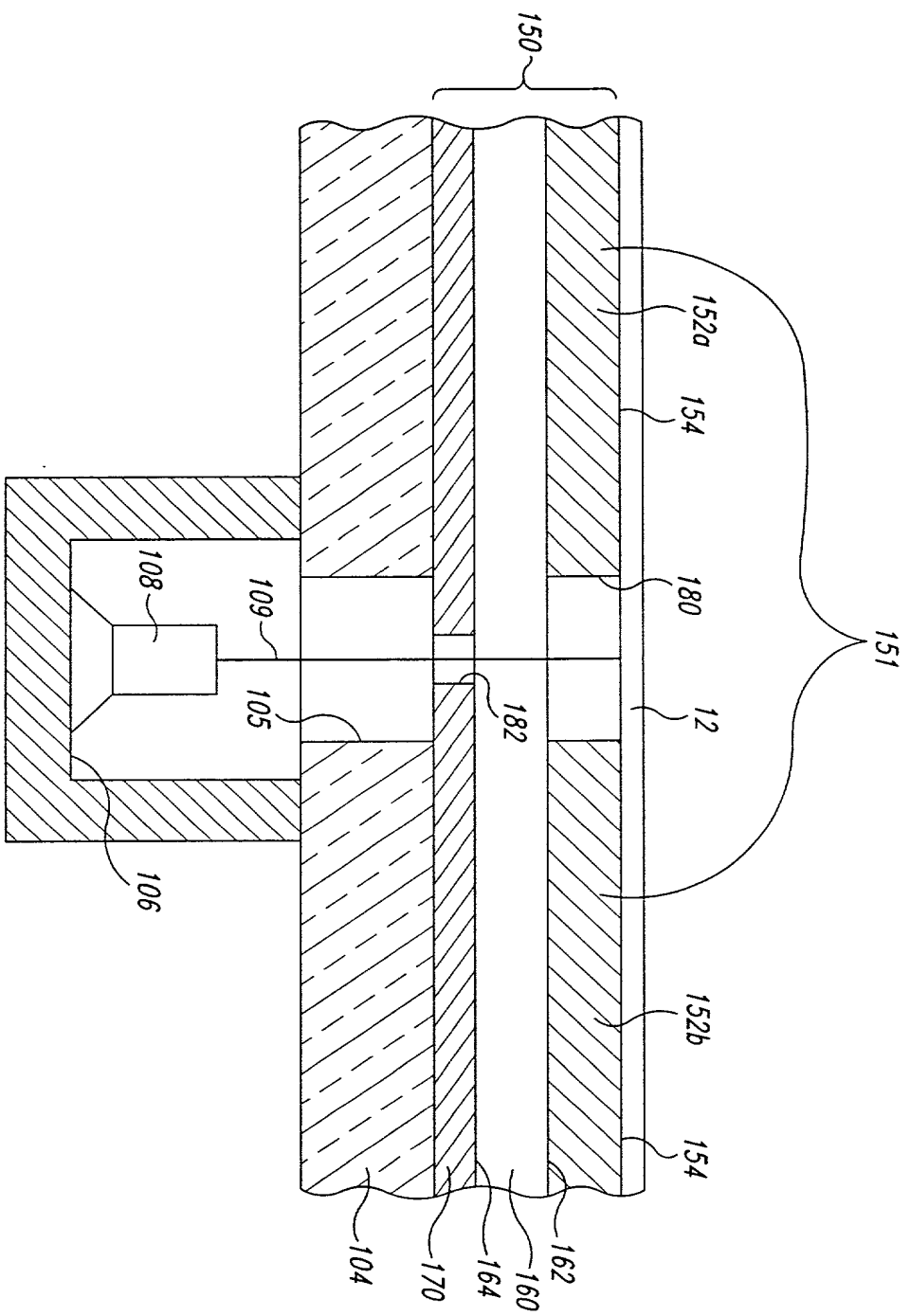


Fig. 3

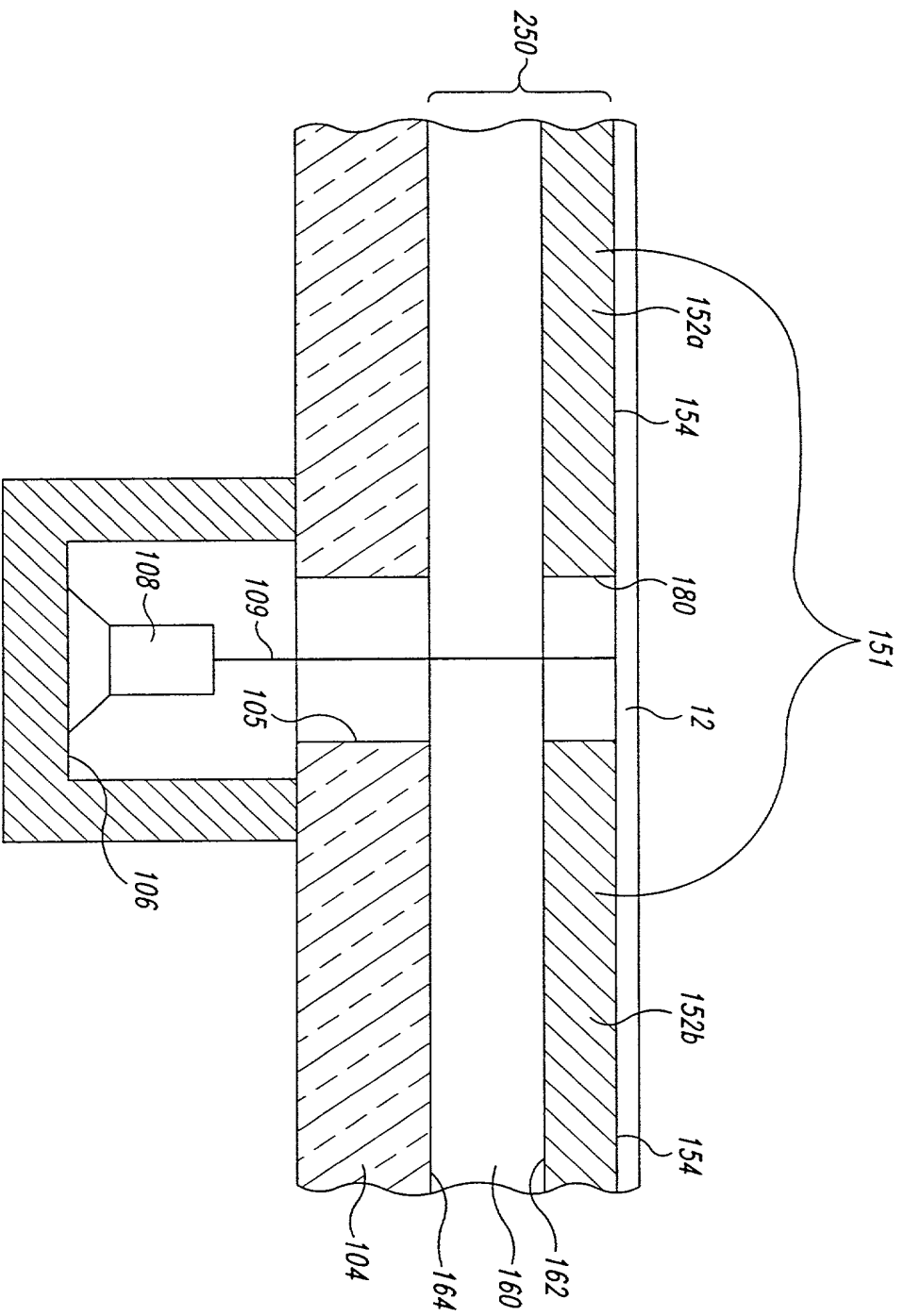


Fig. 4

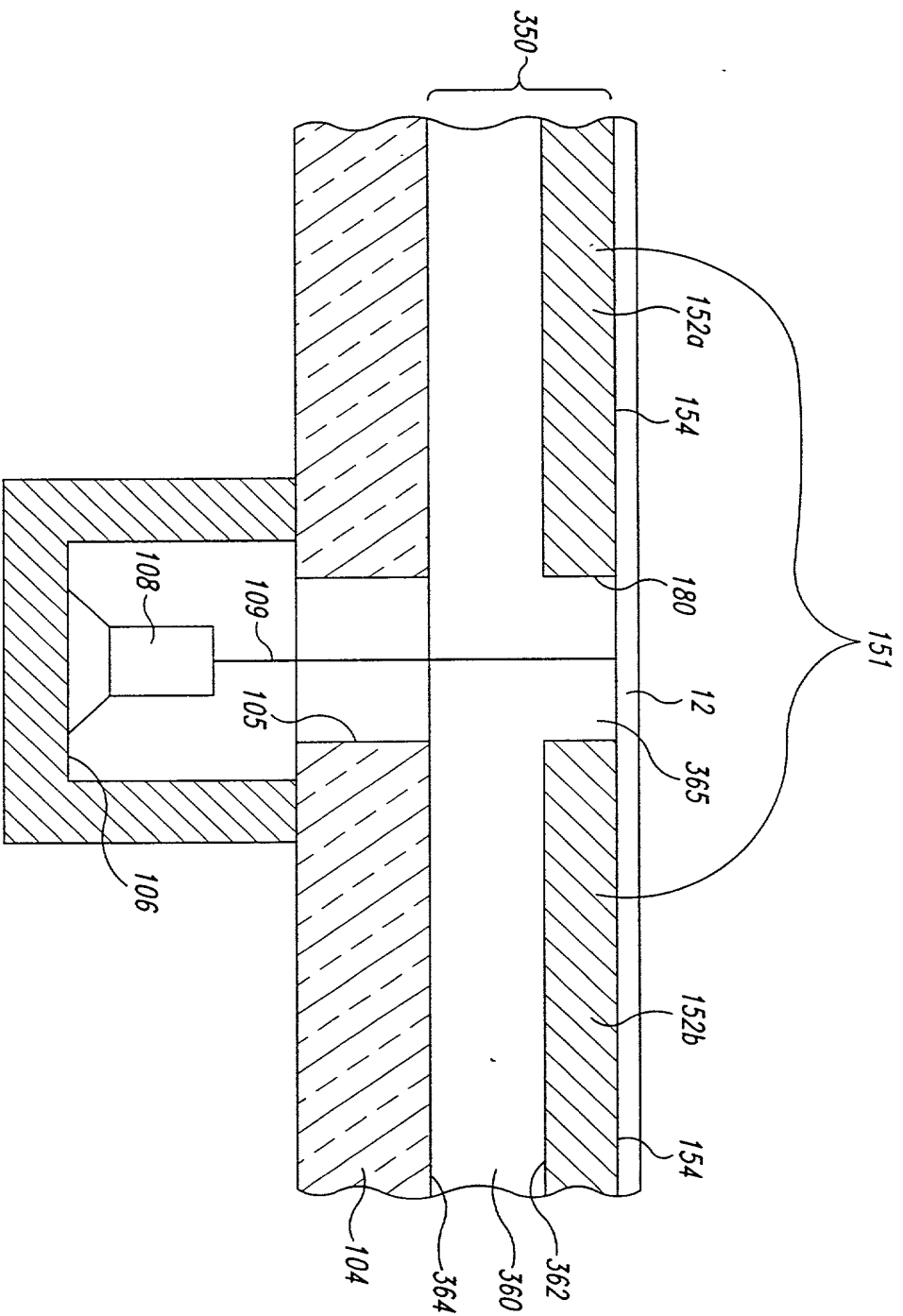


Fig. 5



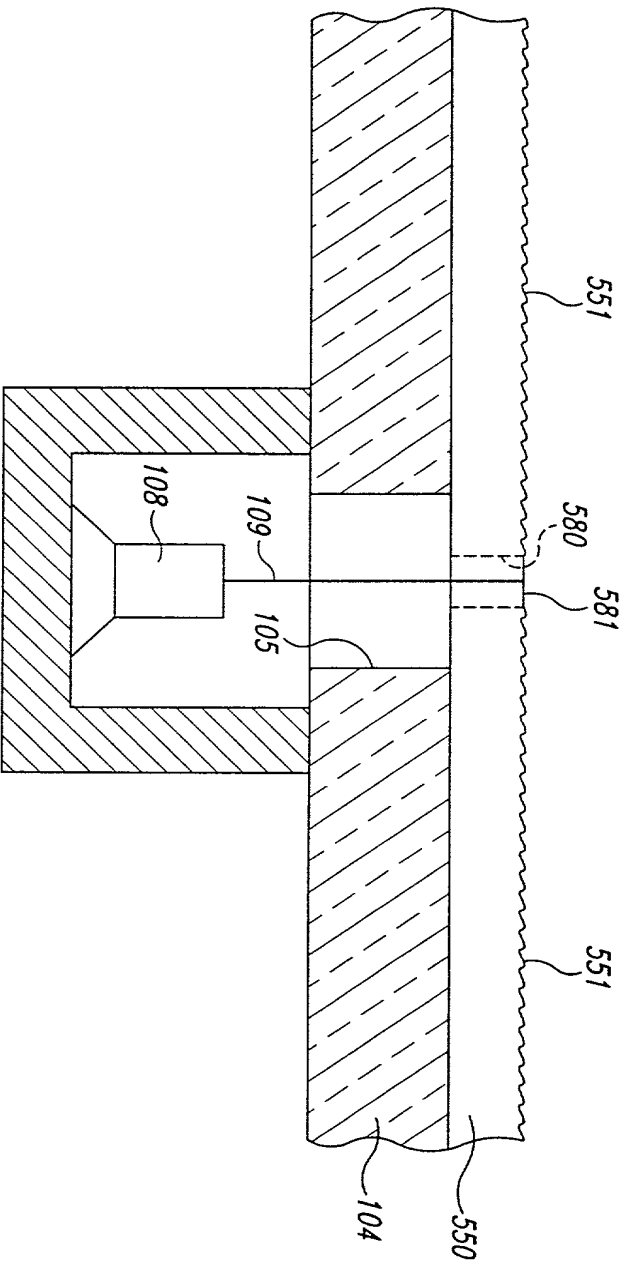


Fig. 7

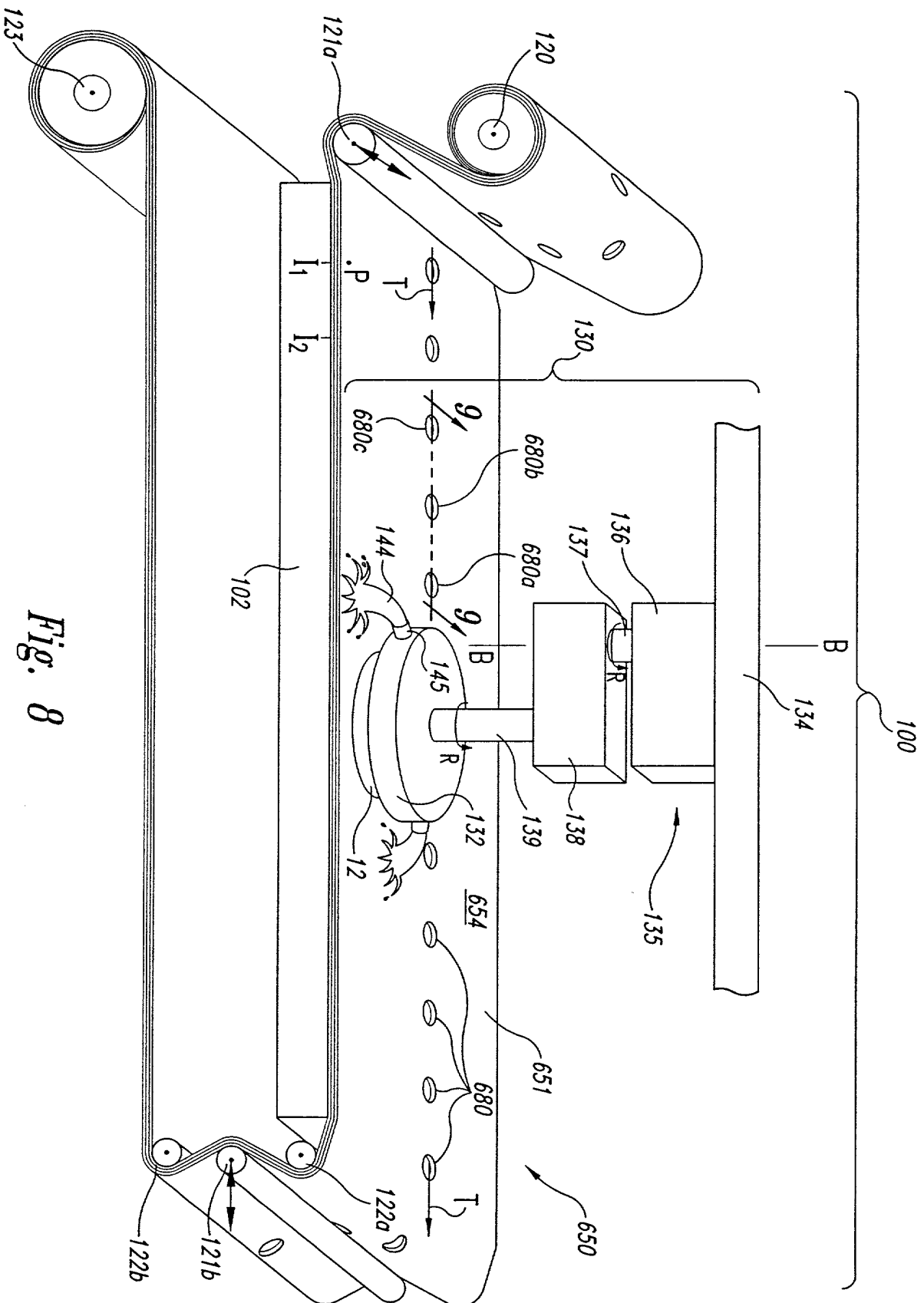


Fig. 8

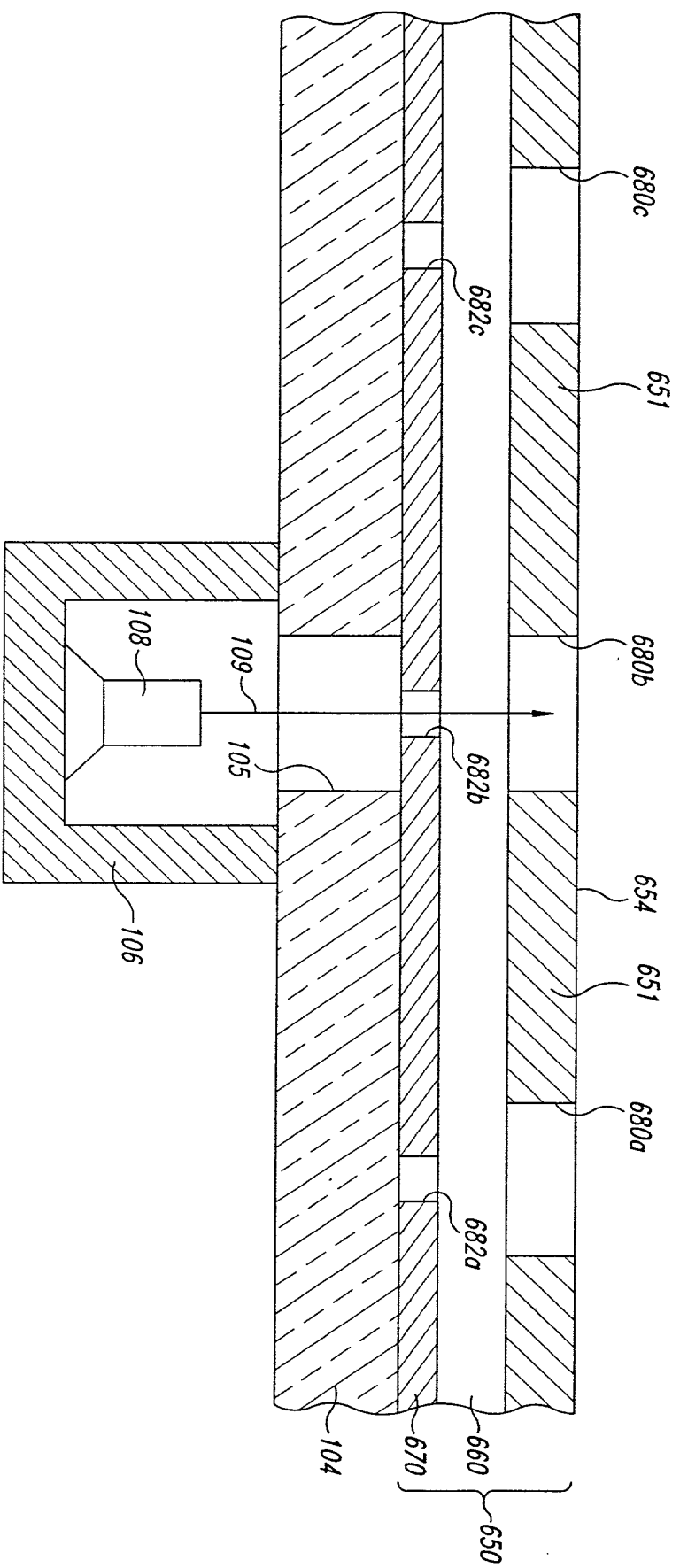


Fig. 9



## DECLARATION

As the below-named inventor, I declare that:

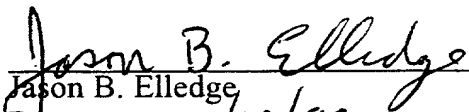
My residence, post office address, and citizenship are as stated below under my name.

I believe I am the original, first, and sole inventor of the invention entitled "APPARATUS FOR IN-SITU OPTICAL ENDPOINTING ON WEB-FORMAT PLANARIZING MACHINES IN MECHANICAL OR CHEMICAL-MECHANICAL PLANARIZATION OF MICROELECTRONIC-DEVICE SUBSTRATE ASSEMBLIES AND METHODS FOR MAKING AND USING SAME," which is described and claimed in the foregoing specification and for which a patent is sought.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to herein (if any).

I acknowledge my duty to disclose information of which I am aware which is material to patentability and examination of this application in accordance with 37 C.F.R. § 1.56(a).

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that the making of willfully false statements and the like is punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and may jeopardize the validity of any patent issuing from this patent application.

  
\_\_\_\_\_  
Jason B. Elledge  
Date 4/19/99

Residence : City of Boise, County of Ada  
State of Idaho  
Citizenship : United States of America  
P.O. Address : 13376 W. Hazelnut Street  
Boise, Idaho 83713

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Jason B. Elledge  
Filed : Concurrently herewith  
For : APPARATUS FOR IN-SITU OPTICAL ENDPOINTING  
ON WEB-FORMAT PLANARIZING MACHINES IN  
MECHANICAL OR CHEMICAL-MECHANICAL  
PLANARIZATION OF MICROELECTRONIC-DEVICE  
SUBSTRATE ASSEMBLIES AND METHODS FOR  
MAKING AND USING SAME

Docket No. : 660073.780

Box Patent Application  
Assistant Commissioner for Patents  
Washington, DC 20231

ELECTION UNDER 37 C.F.R. §§ 3.71 AND 3.73 AND POWER OF ATTORNEY

Sir:

The undersigned, being Assignee of the entire interest in the above-identified application by virtue of an Assignment filed concurrently herewith, hereby elects, under 37 C.F.R. § 3.71, to prosecute the application to the exclusion of the inventor.

Assignee hereby appoints RICHARD W. SEED, Reg. No. 16,557; ROBERT J. BAYNHAM, Reg. No. 22,846; EDWARD W. BULCHIS, Reg. No. 26,847; GEORGE C. RONDEAU, JR., Reg. No. 28,893; DAVID H. DEITS, Reg. No. 28,066; WILLIAM O. FERRON, JR., Reg. No. 30,633; PAUL T. MEIKLEJOHN, Reg. No. 26,569; DAVID J. MAKI, Reg. No. 31,392; RICHARD G. SHARKEY, Reg. No. 32,629; DAVID V. CARLSON, Reg. No. 31,153; KARL R. HERMANN, Reg. No. 33,507; DAVID D.

MCMASTERS, Reg. No. 33,963; MICHAEL J. DONOHUE, Reg. No. 35,859; CHRISTOPHER J. DALEY-WATSON, Reg. No. 34,807; STEVEN D. LAWRENZ, Reg. No. 37,376; ROBERT G. WOOLSTON, Reg. No. 37,263; ELLEN M. BIERMAN, Reg. No. 38,079; PAUL T. PARKER, Reg. No. 38,264; ANN T. KADLECEK, Reg. No. 39,244; DAVID W. PARKER, Reg. No. 37,414; BRIAN G. BODINE, Reg. No. 40,520; FRANK ABRAMONTE, Reg. No. 38,066; E. RUSSELL TARLETON, Reg. No. 31,800; THOMAS L. EWING, Reg. No. 34,328; KEVIN S. COSTANZA, Reg. No. 37,801; DALE C. BARR, Reg. No. 40,498; KEVIN S. ROSS, Reg. No. 42,116; PAUL F. RUSYN, Reg. No. 42,118; JOHN M. WECHKIN, Reg. No. 42,216; THOMAS E. LOOP, Reg. No. 42,810; STEPHEN J. ROSENMAN, Reg. No. 43,058; BRIAN L. JOHNSON, Reg. No. 40,033; JAMES D. WHITE, Reg. No. 43,985; KIMTON N. ENG, Reg. No. 43,605; SUSAN D. BETCHER, Reg. No. 43,498; DENNIS M. DEGUZMAN, Reg. No. 41,702; and JANE E.R. POTTER, Reg. No. 33,332, comprising the firm of SEED AND BERRY LLP, 6300 Columbia Center, Seattle, Washington 98104-7092; along with MICHAEL L. LYNCH, Reg. No. 30,871; LIA M. PAPPAS, Reg. No. 34,095; W. ERIC WEBOSTAD, Reg. No. 35,406; WALTER D. FIELDS, Reg. No. 37,130; CHARLES B. BRANTLEY, II, Reg. No. 38,086; SUSAN B. COLLIER, Reg. No. 34,566, KEVIN D. MARTIN, Reg. No. 37,882; and DAVID J. PAUL, Reg. No. 34,692, of Micron Technology, Inc., 8000 South Federal Way, Boise, Idaho 83706-9632, as its attorneys to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. Please direct all telephone calls to **Paul T. Parker** at (206) 622-4900 and telecopies to (206) 682-6031.

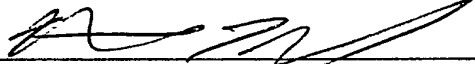
Please direct all communications to:

Paul T. Parker, Esq.  
Seed and Berry LLP  
6300 Columbia Tower  
701 Fifth Avenue  
Seattle, Washington 98104-7092

Pursuant to 37 C.F.R. § 3.73, the undersigned duly authorized designee of Assignee certifies that the evidentiary documents have been reviewed, specifically the Assignment to MICRON TECHNOLOGY, INC., filed concurrently herewith for recording, a copy of which is attached hereto, and certifies that to the best of my knowledge and belief, title remains in the name of the Assignee.

MICRON TECHNOLOGY, INC.  
ASSIGNEE

April 20, 1995  
DATE

  
Michael L. Lynch  
Chief Patent Counsel

Enclosure:  
Copy of Assignment

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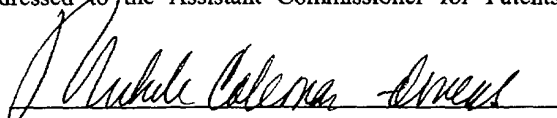
## PATENT

I hereby certify that on the date specified below, this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to the Assistant Commissioner for Patents, Washington, DC 20231.

Date

February 22, 2000

Michele Coleman-Owens



## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Jason B. Elledge

Attorney Docket No.: 660073.780 (500188.01)

Serial No. : 09/300,358

Group Art Unit : 3723

Filed : April 26, 1999

Examiner : W. Berry

Title : APPARATUS FOR IN-SITU OPTICAL ENDPOINTING ON WEB-FORMAT PLANARIZING MACHINES IN MECHANICAL OR CHEMICAL-MECHANICAL PLANARIZATION OF MICROELECTRONIC-DEVICE SUBSTRATE ASSEMBLIES AND METHODS FOR MAKING AND USING SAME

TRANSMITTAL FOR REVOCATION AND SUBSTITUTE POWER OF ATTORNEY

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Transmitted herewith and attached hereto as Addendum A is a true and correct copy of the Revocation and Substitute Power of Attorney executed January 3, 2000, in the above-identified application. The above-identified application is identified on Exhibit A.

Pursuant to 37 C.F.R. § 3.73, Michael L. Lynch, duly authorized designee of Assignee, has certified that the evidentiary documents have been reviewed, specifically the Assignment to MICRON TECHNOLOGY, INC., filed April 26, 1999.

Respectfully submitted,

DORSEY &amp; WHITNEY LLP



Mark W. Roberts, Ph.D.  
Registration No. P-46,160

MWP:mco

Enclosures:

Addendum A

Exhibit A

1420 Fifth Avenue, Suite 3400  
Seattle, Washington 98101-4010  
(206) 903-8800 (telephone)  
(206) 903-8200 (fax)

**ADDENDUM A**

**THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Assistant Commissioner for Patents  
Washington, DC 20231

**REVOCATION AND SUBSTITUTE POWER OF ATTORNEY**

Sir:

In the matter of the patent applications identified in Exhibit A attached hereto, I, MICHAEL L. LYNCH, declare that I am a duly authorized designee of Micron Technology, Inc., the ASSIGNEE of the entire right, title and interest in and to the above-referenced patent applications. Documentary evidence of chain of title from the original owner to ASSIGNEE has been or is concurrently being filed with and recorded by the United States Patent Office. The evidentiary documents referred to in the instant Revocation and Power of Attorney have been reviewed by the undersigned, and it is certified that, to the best of ASSIGNEE's knowledge and belief, title is held solely in and by ASSIGNEE.

On behalf ASSIGNEE, I revoke all power of attorney heretofore given, and hereby appoint EDWARD W. BULCHIS, Reg. No. 26,847; JON F. TUTTLE, Reg. No. 25,713; PAUL T. MEIKLEJOHN, Reg. No. 26,569; GLENN P. RICKARDS, Reg. No. 29,428; DALE C. BARR, Reg. No. 40,498; KIMTON N. ENG, Reg. No. 43,605; DAVID E. BOONE, Reg. No. 27,857; SCOTT W. DOYLE, Reg. No. 39,176; REED R. HEIMBECHER, Reg. No. 36,353; JOHN T. KENNEDY, Reg. No. 42,717; GREGORY D. LEIBOLD, Reg. No. 36,408; GARY M. POLUMBUS, Reg. No. 25,364; THOMAS H. YOUNG, Reg. No. 25,796; W. ROBINSON H. CLARK, Reg. No. 41,530; GREGORY J. GLOVER, Reg. No. 34,173; JOHN K. HARROP, Reg. No. 41,817; CHRIS McWHINNEY, Reg. No. 42,875; ALDO NOTO, Reg. No. 35,628; MATTHEW PHILLIPS, Reg. No. 43,403; JOHN W. RYAN, Reg. No. 33,771; AMI P. SHAH,

Reg. No. 42,143; SEAN S. WOODEN, Reg. No. 43,997; MICHAEL C. GILCHRIST, Reg. No. 40,619; BRIAN J. LAURENZO, Reg. No. 34,207; SHANE COLEMAN, Reg. No. 44,623; RONALD J. BROWN, Reg. No. 29,016; DAVID E. BRUHN, Reg. No. 36,762; DAVID N. FRONEK, Reg. No. 25,678; JOSEPH F. HAAG, Reg. No. 42,612; STUART R. HEMPHILL, Reg. No. 28,084; GRANT A. JOHNSON, Reg. No. 42,696; KENNETH E. LEVITT, Reg. No. 39,747; NIALA A. MACLEOD, Reg. No. 41,963; SCOTT A. MARKS, Reg. No. 44,902; DEVAN V. PADMANABHAN, Reg. No. 38,262; GERALD H. SULLIVAN, Reg. No. 36,311; BRIAN PARK, Reg. No. P-45,519; MARK W. ROBERTS, Reg. No. P-46,160; STEVEN H. ARTERBERRY, Reg. No. P-46,314; of the firm of DORSEY & WHITNEY LLP; along with MICHAEL L. LYNCH, Reg. No. 30,871; LIA M. PAPPAS, Reg. No. 34,095; WALTER D. FIELDS, Reg. No. 37,130; CHARLES B. BRANTLEY, II, Reg. No. 38,086; KEVIN D. MARTIN, Reg. No. 37,882; and DAVID J. PAUL, Reg. No. 34,692, of MICRON TECHNOLOGY, INC., 8000 South Federal Way, Boise, Idaho 83706-9632, as its attorneys to transact all business in the Patent and Trademark Office connected therewith.

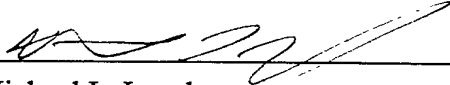
Please direct all future correspondence and telephone calls to:

Edward W. Bulchis  
DORSEY and WHITNEY LLP  
U.S. Bank Centre, Suite 3400  
1420 Fifth Avenue  
Seattle, Washington 98101  
(206)903-8800  
(206)903-8820 facsimile.

ASSIGNEE:

Micron Technology, Inc.

Jan 3, 2000  
Date

By   
Michael L. Lynch  
Chief Patent Counsel

## EXHIBIT A

09/300,358	660073.780	Jason B. Elledge	26-Apr-99	Apparatus for In-Situ Optical Endpointing on Web-Format Planarizing Machines in Mechanical or Chemical-Mechanical Planarization of Microelectronic-Device Substrate Assemblies and Methods for Making and Using Same
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